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Technical note

Reconstruction of the heel shape and volume using V.A.C.: An innovative method

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1. Introduction

Degloving injuries of the heel usually leave tissue deficits which provide a real reconstructive puzzle. Immediately after the initial debriding, a shapeless area on the heel needs direct skin coverage. For this reason, local or distal flaps are mainly used. For small deficits, a plantar flap seems to be the ideal solution [1,2]. For larger deficits, though, distant flaps do not give satisfactory results concerning the shape and strength of the neo-heel [3,4].

2. Reconstruction method

In the Plastic and Reconstructive Surgery Department of the General Hospital of Athens "o Evangellismos", we invented a heel reconstruction method which developed a neo-heel with normal anatomic shape as well as satisfactory strength and tolerance to mechanical stress, such as weight bearing during standing and walking.

A Bakelite mould (thermoplastic material) is first created using the shape of the other healthy heel of the patient. Then, through a hole on top of the mould, topical negative pressure is applied to a polyurethane foam dressing, thus filling the mould. In order to avoid pressure ulcers, we placed hydrogel wound dressing on the contact areas between healthy skin and mould borders. After V.A.C. system application [5,6], we observed the development of high quality and bleeding granulation tissue which filled the empty space between the mould and the wound and formed the anatomical shape of the heel. A full thickness skin graft was later applied to the granulated area.

In other cases where the initial deficit was smaller, a special anaesthetic oxygen mask was used instead of the mould with inflatable borders to protect healthy skin, leaving the same positive final outcome.

We believe that the reconstructive method suggested is simple in its application, does not require special surgical skills and lacks complications while having great aesthetic, as well as functional, results.

3. Clinical cases

Two patients presented with degloving injury of the heel's soft tissue due to foot entrapment in a motorbike wheel. The first patient suffered from total loss of the skin and the underlying soft tissue of the heel (Figs. 1 and 2 – after the initial debridement of the necrotic eschars and tissue). The second degloving injury involved plantar fascia and soft tissue detachment up to the middle of the plantar arch. A loose tissue re-attachment was performed and a draining catheter was placed on site (Figs. 3–5).

During the following post-operative days,we observed gradual skin and soft tissue necrosis which was surgically removed (Figs. 6–9).

After surgical debridement, the wound was left with a skin and soft tissue deficit down to the calcaneus bone without exposing the Achilles tendon sheath. In both cases, the above reconstructive method was applied [7]:

- A mould was formatted based on the healthy heel (using thermoplastic material) or an anaesthetic oxygen mask with inflatable borders was used (no reshaping required) (Figs. 10–12).
- Negative pressure was applied locally through a hole directly to the polyurethane sponge which fulfilled the empty space (Figs. 13 and 14) [8–10].
- Development of a high vascularised granulation tissue following the anatomical shape of the heel (Figs. 15–17).
- Full thickness skin grafting (Figs. 18–20).

We followed up the patients for more than 6 months. During this period of time, results were highly satisfactory:

- No eruption or erosion of the skin graft was noticed on the site.
- Only a light contraction of the neo-heel was noticed.
- Patients were able to wear regular shoes.
- Patients had no difficulty standing or walking (Figs. 21–23).

4. Comments

We believe that further improvement of this reconstructive method can be made through:

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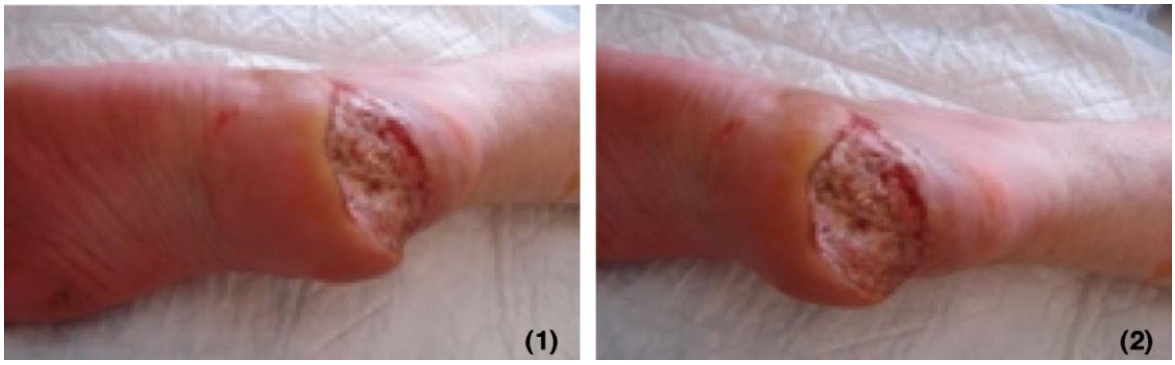
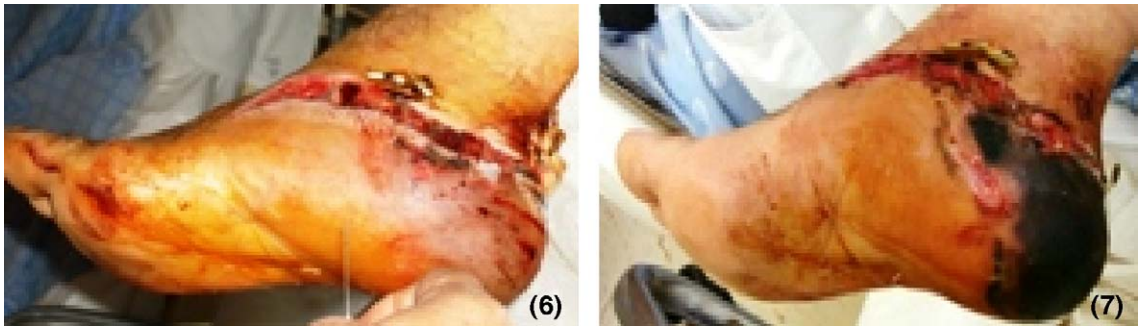


Figs. 1 and 2. Patient 1: after the initial debridement of the necrotic eschars and tissue.

Figs. 3–5. Patient 2: degloving injury of the plantar fascia and soft tissue up to the middle of the plantar arch. A loose tissue re-attachment was performed and a draining catheter was placed on site.



Figs. 6 and 7. Gradual skin and soft tissue necrosis in the first post-operative days.

Fig. 8. Surgical debridement of the necrosis.

Fig. 9. The necrotic tissues.

Fig. 10. The formation of a mould based on the healthy heel with thermoplastic material.

Fig. 11. The mould.

Fig. 12. The alternative solution: an anaesthetic oxygen mask with inflatable borders was used (no reshaping required).

- Overcorrection of the final volume of the heel using a larger mould to face up to granulation tissue and skin graft contraction.
- Coverage of the granulation tissue initially with one or two layers of artificial dermis (bovine or human) and finally with full thickness skin graft for even further improvement in strength.
- Combination of a V.A.C. "window" and a total contact cast on the foot which permits off-loading [11,12], walking and standing (V.A.C. walker) in order to reduce hospitalisation time so that this procedure may be performed on an outpatient basis.

Fig. 13. Negative pressure was applied locally through a hole directly to the polyurethane sponge which fulfilled the empty space – using the oxygen mask.

Fig. 14. Negative pressure was applied locally through a hole directly to the polyurethane sponge which fulfilled the empty space – using the mould.

Fig. 15. Patient 1: development of a high vascularised granulation tissue.

Figs. 16 and 17. Patient 2: development of a well vascularised granulation tissue, following the anatomical shape of the heel.

Figs. 19 and 20. Patient 2: application of a full thickness skin graft over the granulation tissue.

Fig. 18. Patient 1: application of a full thickness skin graft over the granulation tissue.

Fig. 21. Patient 1: final result.

Figs. 22 and 23. Patient 2: final results.

5. Conclusion

This is an original method of heel reconstruction with a very pleasing aesthetic, as well as functional, outcome that could gain wide acceptance.

References

1. McCraw JB. Selection of alternative local flaps in the leg and foot. Clin Plast Surg 1979;6(April (2)):227–46.
2. Grabb WC, Argenta LC. The lateral calcaneal artery skin flap (the lateral calcaneal artery, lesser saphenous vein, and sural nerve skin flap). Plast Reconstr Surg 1981;68(November (5)):723–30.
3. Shanahan RE, Gingrass RP. Medial plantar sensory flap for coverage of heel defects. Plast Reconstr Surg 1979;64(September (3)):295–8.
4. Morrison WA, Crabb DM, O'Brien BM, Jenkins A. The instep of the foot as a fasciocutaneous island and as a free flap for heel defects. Plast Reconstr Surg 1983;72(July (1)):56–65.
5. Argenta LC, Morykwas MJ. Vacuum-assisted closure: a new method for wound control and treatment: clinical experience. Ann Plast Surg 1997;38(June (6)):563–76 [discussion 577].
6. Armstrong DG, Lavery LA. Decreasing foot pressures while implementing topical negative pressure (vacuum-assisted closure) therapy. Int J Low Extrem Wounds 2004;3:12–5.
7. DeFranzo AJ, Argenta LC, Marks MW, Molnar JA, David LR, Webb LX, et al. The use of vacuum-assisted closure therapy for the treatment of lower extremity wounds with exposed bone. Plast Reconstr Surg 2001;108(5): 1184–91.
8. DeFranzo AJ, Marks MW, Argenta LC, Genecov DG. Vacuum-assisted closure of treatment of degloving injuries. Plast Reconst Surg 1999;104(7): 2145–8.
9. Dill-Müller D, Bonowitz A, Wagner A, Tilgen W. Vacuum assisted wound closure after excision of a high risk melanoma heel wound—using the V.A.C. heel-dressing. Zentralbl Chir 2004;129(May (Suppl 1)):S108–12.
10. Mauckner P. The treatment of heel pressure ulcer with V.A.C. therapy using the new V.A.C. GranuFoam "Heel-Dressing". Zentralbl Chir 2004;129(May (Suppl 1)):S104–7.
11. Tamir E, Daniels TR, Finestone A, Nof M. Off-loading of hindfoot and midfoot neuropathic ulcers using a fiberglass cast with a metal stirrup. Foot Ankle Int 2007;28(October (10)):1048–52.
12. Tamir E, Daniels TR. Off-loading neuropathic plantar heel ulcers with a metal stirrup brace: case report. Foot Ankle Int 2007;28(March (3)):385–7.